10th Class 2021		
Physics	Group-II	Paper-II
Time: 1.45 Hours	(Subjective Type)	Max. Marks: 48

(Part-I)

2. Write short answers to any Five (5) questions: (10)

(i) Power that: $v = f\lambda$

Ans The velocity of wave is defined as:

$$\text{Velocity} = \frac{\text{distance}}{\text{time}}$$

$$v = \frac{d}{t}$$

If time taken by the wave in moving from one point to another is equal to its time period T, then the distance covered by the wave will be equal to one wavelength, hence we can write

$$v = \frac{\lambda}{T}$$

But time period T, is reciprocal of the frequency f, *i.e.*, $T = \frac{1}{f}$.

Hence proved

$$v = f\lambda$$

(ii) What is a spring constant? Write its unit.

Ans According to Hooke's law, this force is directly proportional to the change in length x of the spring *i.e.*,

$$F = -kx$$

where x is the displacement of the mass from its mean position O, and k is a constant called the **spring constant** defined as:

$$k = -\frac{F}{x}$$

The value of k is a measure of the stiffness of the spring. Stiff springs have large value of k and soft springs have small value of k.

Unit:

The unit of spring constant (k) is Nm^{-1}, newton per meter.

(iii) Define restoring force.

Ans The force exerted by the spring is always directed opposite to the displacement of the mass. Because the spring force always acts towards the mean position, it is sometimes called a restoring force.

A restoring force always pushes or pulls the object performing oscillatory motion towards the mean position.

(iv) Describe how the sound is produced?

Ans Like other waves, sound is also produced by vibrating bodies. Due to vibrations of bodies, the air around them also vibrates and the air vibrations produce sensation of sound in our ear. For example, in a guitar, sound is produced due to the vibrations of its strings.

(v) Calculate the frequency of sound wave of speed 340 ms^{-1} and wavelength 0.5 m.

Ans Given that;

Speed of waves $v = 340\ ms^{-1}$

Wavelength $\lambda = 0.5\ m$

Using the formula,

$$v = f\lambda$$

Putting the values

$$f = 340\ ms^{-1} / 0.5\ m = 680\ Hz$$

(vi) What are spherical mirrors? Name their two types.

Ans A mirror whose polished, reflecting surface is a part of a hollow sphere of glass or plastic is called a spherical mirror. In a spherical mirror, one of the two curved

surfaces is coated with a thin layer of silver followed by a coating of red lead oxide paint. Thus, one side of the spherical mirror is opaque and the other side is a highly polished reflecting surface.

There are two types of spherical mirrors which are as follows:

(a) Concave mirror (b) Convex mirror

(vii) What is mirror formula? Write down its equation.

Ans Mirror formula is the relationship between object distance p, image distance q from the mirror and focal length f of the mirror.

Thus we can write mirror formula as:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q} \ldots\ldots$$

(viii) State the laws of refraction.

Ans **Laws of Refraction:**

(i) The incident ray, the refracted ray, and the normal at the point of incidence all lie in the same plane.

(ii) The ratio of the sine of the angle of incidence 'i' to the sine of the angle of refraction 'r' is always equal to a constant *i.e.*, sin i / sin r = constant = n

where the ratio sin i / sin r is known as the refractive index of the second medium with respect to the first medium. So we have

$$\frac{\sin i}{\sin r} = n$$

It is called Snell's law.

3. Write short answers to any Five (5) questions: (10)

(i) Define electric power and write its unit.

Ans The amount of energy supplied by current in unit time is known as electric power.

Hence power P can be determined by the formula

Electric power P = electrical energy/time = W/t

where W is the electrical energy given by

$$W = QV$$

Therefore, above equation becomes

Electric power

$$P = \frac{QV}{t} = IV = I^2 R$$

(ii) State Joule's law and write its formula.

Ans From Ohm's law, we have $V = I R$

So the energy supplied by Q charge is

$$W = I^2 Rt = \frac{V^2 t}{R}$$

This equation is called Joule's law, stated as:

The amount of heat generated in a resistance due to flow of charges is equal to the product of square of current I, resistance R and the time duration t.

(iii) Define electromotive force and write its unit.

Ans It is the energy supplied by a battery to a unit positive charge when it flows through the closed circuit. Or The energy converted from non-electrical forms to electrical form when one coulomb of positive charge passes through the battery.

Thus, $$e.m.f = \frac{Energy}{Charge}$$

or $$E = \frac{W}{Q}$$

The unit for e.m.f. is JC^{-1} which is equal to volt (V) in SI system.

(iv) State Lenz's law.

Ans **Lenz's law:**

Lenz devised a rule to find out the direction of a current induced in a circuit. The direction of an induced current in a circuit is always such that it opposes the cause that produces it.

(v) What is meant by mutual induction?

Ans The phenomenon of production of induced current in one coil due to change of current in a neighboring coil is called mutual induction.

(vi) Define OR gate and write its truth table.

Ans OR operation is represented by the symbol of plus (+). Boolean expression for OR operation is : X = A + B and is read as " X equals A OR B". An OR operation may be represented by switches connected in parallel, since only one of these parallel switches need to turn on in order to flow current in the circuit. The electronic circuit which implements the OR operation is known as OR gate.

A	B	X = A+B
0	0	0
0	1	1
1	0	1
1	1	1

(vii) Write the name of logic operations.

Ans There are three logic operations which are as follows:

(a) AND Operation (b) OR Operation
(c) NOT Operation

(viii) Draw a symbolic diagram for NAND gate and write its truth table.

Ans

NAND gate

A	B	X = $\overline{A . B}$
0	0	1
0	1	1
1	0	1
1	1	0

4. **Write short answers to any Five (5) questions: (10)**

(i) **Write two characteristics of electric field lines.**

Ans Following are the two characteristics of electric field lines:

1. The direction of electric field intensity in an electric field can also be represented by drawing lines. These lines are known as electric lines of force. These lines were introduced by Michael Faraday.
2. The field lines are imaginary lines around a field charge with an arrow head indicating the direction of force. Field lines are always directed from positive charge towards negative charge.

(ii) **Define potential difference and write its formula.**

Ans Energy supplied by the charge = $q (V_a - V_b)$

If 'q' is one coulomb, then the potential difference between two points becomes equal to the energy supplied by the charge. Thus, we define potential difference between two points as:

The energy supplied by a unit charge as it moves from one point to the other in the direction of the field is called potential difference between two points.

(iii) **Define capacitance and write its unit.**

Ans Capacitance of the capacitor is defined as the ability of the capacitor to store charge. It is given by the ratio of charge and the electric potential as:

$$C = \frac{Q}{V}$$

SI unit of capacitance is farad (F).

(iv) **What is internet?**

Ans When many computer networks of the world were connected together, with the objective of communicating with each other, Internet was formed. In other words, we

can say that Internet is a network of networks, which spreads all across the globe.

(v) What is meant by data?

Ans Data are facts and figures that are used by programs to produce useful information.

(vi) Write two advantages of electronic mail.

Ans Two advantages of e-mail are:

1. Versatile:

Pictures or other files can also be sent through e-mail.

2. Fast communication:

We can send messages anywhere in world instantly.

(vii) Write the general equation of gamma decay and write an example.

Ans **Gamma (γ)-decay**

General Equation:

$$\underset{\text{parent nuclide}}{{}^{A}_{Z}X^{*}} \longrightarrow \underset{\text{daughter nuclide}}{{}^{Z}_{6}X} + \underset{\text{gamma rays}}{\gamma}$$

Example:

$$\underset{\text{cobalt}}{{}^{60}_{27}Co^{*}} \longrightarrow \underset{\text{cobalt}}{{}^{60}_{27}Co} + \underset{\gamma\text{-rays}}{{}^{0}_{0}\gamma} + \text{Energy}$$

Gamma rays are usually emitted along with either an alpha or a beta particle.

(viii) What is meant by ionization power?

Ans The phenomenon by which radiations split matter into positive and negative ions is called ionization. All three kinds of radiations *i.e.*, alpha, beta and gamma can ionize the matter. However, alpha particles have the greatest power of ionization as compared to beta particles and gamma rays. It is due to large positive charge and large mass of alpha particles.

(Part-II)

NOTE: Attempt any Two (2) questions.

Q.5.(a) Prove that vibratory motion of a mass attached to a spring is S.H.M. (4)

Ans For Answer see Paper 2018 (Group-II), Q.5.(a).

(b) A capacitor holds 0.06 coulombs of charge when fully charged by a 9 volt battery. Calculate capacitance of the capacitor. (5)

Ans Given data:

$Q = 0.06\ C$

$V = 9\ Volts$

$C = ?$

The capacitor equation:

$$Q = CV$$

$$C = \frac{Q}{V}$$

Putting the values,

$$C = \frac{0.06}{9}$$

$$\boxed{C = 0.007\ F}$$

Q.6.(a) What is transformer? Explain its construction and types. (4)

Ans **Transformer:**

The transformer is a practical application of mutual induction. Transformers are used to increase or decrease AC voltages. Usage of transformers is common because they change voltages with relatively little loss of energy. In fact, many of the devices in our homes, such as game systems, printers, and stereos use transformers for their working.

Working of a transformer:

A transformer has two coils, electrically insulated from each other, but wound around the same iron core.

One coil is called the primary coil. The other coil is called the secondary coil. Number of turns on the primary and the secondary coils are represented by N_p and N_s, respectively.

When the primary coil is connected to a source of AC voltage, the changing current creates a changing magnetic field, which is carried through the core to the secondary coil. In the secondary coil, the changing field induces an alternating e.m.f.

The e.m.f. induced in the secondary coil, called the secondary voltage V_s, is proportional to the primary voltage V_p. The secondary voltage also depends on the ratio of the number of turns on the secondary coil to the number of turns on the primary coil, as shown by the following expression:

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

If the secondary voltage is larger than the primary voltage, the transformer is called a step-up transformer. If the secondary voltage is smaller than the primary voltage, the transformer is called a step-down transformer. In an ideal transformer, the electric power delivered to the secondary circuit is equal to the power supplied to the primary circuit. An ideal transformer dissipates no power itself, and for such a transformer, we can write:

$$P_p = P_s$$

$$V_p I_p = V_s I_s$$

(b) An object and its image in a concave mirror are of a same height, yet inverted, when the object is 20 cm from the mirror. What is focal length of mirror? (5)

Ans For Answer see Paper 2017 (Group-I), Q.5.(b).

Q.7.(a) Define natural radioactivity. Also write any three characteristics of alpha particles. (4)

Ans Subsequent experiments performed by Henrey Becquerel suggested that radioactivity was the result of the decay or disintegration of unstable nuclei.

The spontaneous emission of radiation by unstable nuclei is called natural radioactivity. And the elements which emit such radiations are called radioactive elements. Three types of radiation are usually emitted by a radioactive substance. They are: alpha (α) particles; beta (β) particles; and gamma (γ) rays.

Characteristics of alpha particles:

There are three characteristics of alpha particles:

1. Alpha particle is a helium nucleus comprising of two protons and two neutrons with a charge of $2e^-$.
2. An unstable nucleus with large protons and neutrons may decay by emitting alpha radiations.
3. Alpha particles have the greatest power of ionization.

(b) Calculate one month cost of using 50W energy savers for 8 hours daily in your study room. Assume that the price of a unit is Rs. 12. (5)

Ans Given data:

Power of energy savers = 50 W

Price per unit = Rs. 12

Required:

Monthly cost = ?

Formula:

$$\text{Energy consumed by bulb} = \frac{\text{Power (watt)} \times \text{time (hour)}}{1000}$$

By putting values:

$$\text{Energy consumed by bulb} = \frac{50\ \text{W} \times 8 \times 30}{1000} = 12 \text{ units}$$

$$\text{Price of electricity} = 12 \times 12$$

$$= 144 \text{ Rs.}$$